

northern latitudes, and finally discusses periodic alterations of the three elements upon which the distribution of temperature must be based, namely, the temperature of the intertropical belt, the radiative power of the air, and the intensity of the general circulation. He thus outlines a general theory of climatic changes.

The processes of reasoning are mathematical, and are set out with exemplary clearness; in order to get numerical results a great number of assumptions are necessarily made. So long as the discussion is confined to the consideration of the earth as a whole and normal temperatures are treated as a simple function of the latitude, a good deal of liberty may be allowed in the other assumptions; but when we get to close quarters with current meteorological experience some of them will naturally need adjustment. It seems odd that in dealing with periodic changes the best known periodic change from winter to summer did not challenge the author's curiosity. It seems nearer at hand than the influence of sun-spots or Brückner's cycle.

The justification for using the Austausch A as a numerical symbol of the effect of the whole irregular atmospheric motion of middle latitudes would be complete if it could be shown that its measure from time to time would do instead of the study of the motion itself. From that point of view the winds at Potsdam can be regarded only as a beginning, and not a very good one. The winds at Bergen would certainly tell a very different story. The next step appears to be a closer examination of some data for Austausch.

One more point is noteworthy. Prof. Defant is apparently under the impression that in consequence of the conservation of momentum winds of 300 m./sec. are a meteorological possibility from the occurrence of which we are saved by the turbulence of middle latitudes. What we thought to be the causes of our worst gales appear as our safeguard against being blown away completely by winds of tenfold velocity. But in our practice we have become accustomed to regard winds as inevitably related to pressure differences. Prof. Marvin, of the United States Weather Bureau, has recently pointed out that the idea of winds of 300 m./sec. is one of the common fallacies about the atmosphere that not even the *cognoscenti* have escaped, and that in face of the "geoidal slope" they could not occur, turbulence or no turbulence. It is, therefore, a little disconcerting to find that Prof. Defant deploys the power of the Austausch to destroy them: disconcerting for this reason, that we are apparently put in possession of an engine that is powerful enough to reduce winds of 300 m./sec. to 20 m./sec.

if it were wanted, and it is not wanted. What then becomes of its power? Has the power of the engine been over-estimated, or has it other work to do?

It is true that Prof. Defant's remark is merely an *obiter dictum*, and has no influence upon his reasoning; but the same idea stares one in the face from the diagrams of Ferrel, J. Thomson, and others, and is quoted by more recent authors. It is time it was cleared off the field of meteorological theory.

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Forensic Chemistry.

Forensic Chemistry. By A. Lucas. Pp. viii + 268. (London: Edward Arnold and Co., 1921.) 15s. net.

MR. A. LUCAS, who is the director of the Government Analytical Laboratory and Assay Office, Cairo, claims that his book is the first of its kind in English, with the possible exception of a small work on legal chemistry which he published in 1920, out of which the present work has grown. In a limited sense the claim may be valid, although the distinction between forensic chemistry and forensic medicine, on which latter subject there are many well-established treatises, is one of degree rather than of kind. Hitherto works on forensic medicine have included forensic chemistry. The expert on forensic medicine has usually been a medical man with knowledge and experience of the detection of chemical substances, such as poisons, which may form the subject of criminal investigation. Strictly speaking, the two branches are, however, perfectly distinct, and there has been a growing tendency within recent years to differentiate them. The criminal who contemplates murder, for example, has far more means at his disposal nowadays than formerly. Science has furnished him with methods unknown to former generations, and these can be combated and checked only by methods of science. It was inevitable, therefore, that public security should require the establishment of a special class of expert whose duty should be the study and application of methods of detection and recognition by chemical means of the many agents and appliances which may now form the subject of criminal inquiry.

But forensic or legal chemistry, as Mr. Lucas points out, may be concerned not only with examinations for the presence or absence of particular substances, such as poisons, but with questions which are only partly chemical, as the examination of blood-stains, questioned documents, counterfeit coins, fibres and textile fabrics—in fact, any problem of criminal

investigation in which chemistry may be of service in the administration of justice and with which medicine as such may have little or no concern.

Mr. Lucas's book, as might be expected, is largely based upon his experience of the methods of the criminal of the East, who, although he may not have all the appliances of his Occidental *confrère*, is scarcely less resourceful. Indeed, some of the instances of ingenuity and cunning to which Mr. Lucas incidentally refers may be recommended to the notice of writers of detective stories. Invested with all the glamour of the Orient, they would form a new departure in that class of literature.

The book is eminently practical, although it omits details of manipulation and methods of examination to be found in standard treatises on chemical analysis. It presupposes, in fact, that the chemist who embarks on the subject of forensic chemistry is a well-trained analyst with a sound knowledge of general chemistry. At the same time, it gives in detail the special methods needed by the expert. In a short introductory chapter the author offers very wise advice on the practice of forensic chemistry, evidently based upon personal experience and a wide reading of notable trials. Legal procedure, it must be admitted, is at times eminently unscientific. It might be supposed that the practice of the law would tend to the cultivation of the scientific spirit in its practitioners, but observation shows that this is far from being uniformly the case. This fact constitutes a difficulty with which the chemical expert has occasionally to contend. The rules of conduct which Mr. Lucas lays down may enable him to meet it. The value of the expert's testimony depends largely upon the manner in which he presents it and upon the soundness and extent of knowledge with which he is able to support it. The lengths to which cross-examination may go are almost limitless, and side-issues may be developed which require wide and accurate general knowledge to deal with satisfactorily. At the same time, the forensic chemist must never forget that he is not an advocate or a partisan; his single object should be to assist the court to a just decision.

Every kind of criminal investigation with which the chemist may be called upon to deal, such as the testing of blood-stains, the analytical examination of bullets and other projectiles for firearms, of clothing, counterfeit coins, documents, explosives and explosions, fibres, finger-prints, fires and firearms, poisons and narcotics, etc., is covered in Mr. Lucas's book. As regards blood-testing in legal cases, the author rightly insists that it should be undertaken only by those who have considerable experience of the work. The sources of error are frequently many, and the issues

may be most serious. The chapter dealing with this subject is an excellent example of the care and caution with which the author approaches any question of chemical jurisprudence. Dealing with projectiles, it is only necessary to recall the Monson trial to realise how much may depend upon the analytical examination of projectiles, wads, and cartridges, the number and width of marks made by the rifling of the barrel, the direction of its twist, the presence of rust, etc. As regards clothing, the author shows how the examination of a waistcoat led to the detection and conviction of a German spy during the war of 1914-18.

Counterfeit coining seems to be very prevalent in Egypt. The coins are usually struck, and many, we are told, are excellent imitations. A few illustrative cases are given, some of which display considerable ingenuity in adapting primitive appliances and apparatus intended for other purposes. The examination of suspected documents in cases of substitution or forgery may require the testing of the paper for the nature of the fibre, the recognition of water-marks, the analysis of the ink employed, the style of pen used, etc. Cases met with in Egypt evidently present difficulties not usually present in European countries.

Knowledge gained during the war has undoubtedly led to a great extension of the use of high explosives for criminal purposes, especially in the form of bombs as a means of assassination, and the chemico-legal expert is not infrequently called upon to examine them in connection with attempts at murder. Such examinations are, of course, often attended with danger, and need to be made with circumspection and care. The precautions to be taken are set out in some degree of detail. Of recent years Egypt has been particularly fruitful of instances of the kind, in which Mr. Lucas or his assistants would seem to have had ample scope for the exercise of their courage, skill, and ingenuity.

But the "tyranny of space" forbids any further attempt to illustrate the possibilities of chemistry as applied to the detection of crime. For other examples the reader may be referred to the book under review. The possibilities are, in fact, boundless. Mr. Lucas shows how the chemical examination of stains and marks, dust and dirt, even of tobacco, may afford clues which may lead to the conviction of criminals. Indeed, one rises from the perusal of his book with the feeling that the ideal forensic chemist would be a combination of Sherlock Holmes with a comprehensive compendium of general and analytical chemistry such as might be embodied in a person of whom fiction has hitherto afforded no example.